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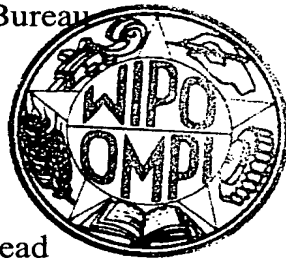
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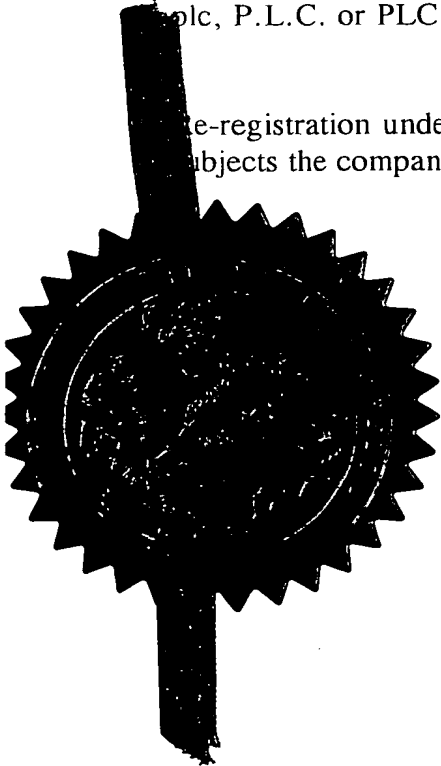
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P. Mahoney

Signed

Dated 1 November 1999



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12 NOV 98 5404117-P D02246
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1. Your reference P/5664.GB DAA

2. Patent application number (The Patent Office will fill in this part) 9824758.8 11 NOV 1998

3. Full name, address and postcode of the or of each applicant (underline all surnames) Danisco A/S Langebrogade 1 PO Box 17 DK-1001 Copenhagen K Denmark
Patents ADP number (if you know it)
If the applicant is a corporate body, give the country/state of its incorporation United Kingdom
SEE 0873002

4. Title of the invention Foodstuff

5. Name of your agent (if you have one) D YOUNG & CO
"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode) 21 NEW FETTER LANE LONDON EC4A 1DA
Patents ADP number (if you have one) 59006

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Description 28

Claims(s) 4

Abstract 1

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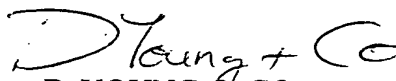
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Any other documents (please specify)

11. I/We request the grant of a patent on the basis of this application.

Signature

Date


D YOUNG & CO
Agents for the Applicants

11/11/1998

12. Name and daytime telephone number of the person to contact in the United Kingdom

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Foodstuff

The present invention relates to a foodstuff. More particularly, the present invention relates to a foodstuff comprising at least one functional ingredient which has been
5 generated *in situ* by a conversion agent.

Traditionally food was prepared in the private households and the constituents of the food or of the foodstuff were brought to the kitchen of the household where the food or foodstuff was prepared shortly before consumption.

10

Industrial development increased the demand for the reduction of the time and effort required to prepare food or foodstuffs. Thus there has been a massive expansion in the industrial preparation of food.

15 Recently, there has been increased demand for improvements in the quality of industrially prepared food. In particular there is demand for improved taste, eating quality and shelf life. In an attempt to address these demands for improved foodstuffs, industrial food producers have utilised and have relied upon functional ingredients to meet the demands for quality and shelf life. Functional ingredients such as emulsifiers,
20 hydrocolloids, preservatives, antioxidants, colourings and flavourings are widely used in the food industry.

More recently, there has been demand from consumers to reduce the number of additives, such as functional ingredients, included in foodstuffs. Thus, there is a desire
25 to prepare industrially foodstuffs meeting the quality requirements of consumers whilst minimising the number of additives in the final foodstuffs.

Both Douglas B. Sarney *et al.*, Enzymatic Synthesis of Sorbitan Esters Using a Low-Boiling-Point Azeotrope as Reaction Solvent, *Biotechnology and Bioengineering*, 1997
30 vol. 54(4) and J. A. Arcosm *et al.*, Quantitative Enzymatic Production of 6-O-Acylglucose Esters, *Biotechnology and Bioengineering* 1998 57(5), teach the use lipase for the production of emulsifiers. The teachings require the synthesis of emulsifiers in

an organic solvent system. The emulsifier is then isolated from the organic solvent system before use in food.

5 A. Coteron *et al.*, Reactions of Olive Oil and Glycerol over Immobilised Lipases, JAOCS, Vol. 75, no. 5 (1998) reports the use of immobilised lipase in the reaction of olive oil and glycerol. Subsequent to the reaction the immobilised lipase is removed from the reaction mixture.

10 JP-A-90188214 reports the use of an immobilised lipase for the hydrolysis and ester exchange of triglyceride. In this process part of the triglyceride is partially hydrolysed to free fatty acid. The partially hydrolysed triglyceride product is used for production of margarine.

15 JP-A-5211852 discloses the addition of a lipase to a mixture of fat and water. The product prepared in this method may be used in the production of mayonnaise. The mayonnaise is prepared at a temperature such that the activity of lipase is not reduced.

The present invention addresses the problem of the prior art

20 According to a first aspect of the present invention there is provided use of a conversion agent to prepare from a food material a foodstuff comprising at least one functional ingredient, wherein the at least one functional ingredient has been generated from at least one constituent of the food material by the conversion agent.

25 According to a second aspect of the present invention there is provided a process for preparing a foodstuff comprising the steps of (i) providing a food material; (ii) contacting the food material with a conversion agent such that a functional ingredient is generated by the conversion agent from at least one constituent of the food material.

30 According to a third aspect of the present invention there is provided a foodstuff prepared from a food material, wherein the foodstuff comprises at least one functional ingredient, and wherein the at least one functional ingredient has been generated from at

least one constituent of the food material by a conversion agent.

By the term “functional ingredient” we mean a constituent of the foodstuff which performs a specific function in the foodstuff. Preferably by the term “functional ingredient” we mean an emulsifier, hydrocolloid, preservative, antioxidant, colouring, 5 flavouring, and/or viscosity modifier.

By the term “foodstuff” we mean a substance which is suitable for human or animal consumption.

10

The above aspects of the present invention are advantageous as they overcome the problems associated with the prior art.

The present invention utilises a conversion agent, such as enzyme, during the 15 production of a foodstuff to generate one or more functional ingredients, for example emulsifiers, antioxidants or preservatives, from a constituent of a food material (i.e. ingredients) from which the foodstuff is prepared. The constituent(s) may be a fat, for example. Thus, instead of adding food additives produced by traditional chemical synthesis, the present invention provides for the *in situ* synthesis of a required functional 20 ingredient.

Traditional chemical synthesis of functional ingredients is problematic because syntheses are often carried out under extreme conditions, such as high temperatures (e.g. ~200°C). Under extreme conditions, side reactions may occur. Thus, although the 25 resultant product may be substantially pure, it may contain undesirable components. To eliminate undesirable components, reactions must be closely controlled and/or the resultant product may require purification, adding to a production process. The present invention aims to overcome these disadvantages.

30 Moreover, by generating the functional ingredient from at least one constituent of the food material using a conversion agent, the foodstuff comprises at least one less “additive” material. This is advantageous because of the improvement in the ease of

production. Moreover, the foodstuff may contain less “additives”. The reduction or elimination of “additives” is desirable to consumers and inclusion of additives often must be declared to the consumer in the ingredients listing on the foodstuff. Thus, the present invention is further advantageous.

5

The food material may be contacted with the conversion agent in any manner. The food material may be contacted with the conversion agent in an immobilised form. The food material may simply be added to the conversion agent or *vice versa*. In the latter aspect, the conversion agent may be subsequently removed from the food material/foodstuff or
10 may remain in the food material/foodstuff. In a preferred aspect the conversion agent is present in the foodstuff.

The above preferred aspect is advantageous because one may contact the food material with the conversion agent to thereby provide a foodstuff suitable for consumption. No
15 further processing or addition of ingredients may be required; a foodstuff comprising a required functional ingredient is produced. Thus a foodstuff may be provided in which a required functional ingredient has been simply generated. Synthesis of the functional ingredient discretely from the foodstuff followed by subsequent addition is not required. Moreover, provided of course the conversion agent is suitably chosen so that it is
20 compatible with a foodstuff i.e. it is edible, further processing of the foodstuff may not be necessary. However, the present invention encompasses foodstuffs which have been further processed.

Preferably, the conversion agent is a catalyst.

25

In a preferred aspect, the conversion agent is an enzyme. This aspect is particularly preferred because enzymes are readily available, may be chosen to convert a specific constituent of the food material and/or may be chosen to generate a specific functional ingredient. Yet further, enzymes may be denatured by heat. Thus in a further preferred
30 aspect, the foodstuff/food material is heated after generation of the functional ingredient. The enzyme will be denatured and may then constitute protein. This is advantageous because the denatured enzyme need not be declared on the foodstuff/food

material ingredients.

The use of enzymes is advantageous because denatured enzymes are considered, particularly under food labelling regulations, to constitute a processing aid. Inactivated
5 enzymes are not considered to be additives; the addition of additives to foodstuffs is undesirable to many consumers.

Inactivation of the conversion agent, in particular denaturation of the enzyme, is advantageous because it allows one to control the amount of functional ingredient
10 generated. For example, the generation of the functional ingredient may be monitored (for example by measurement of the functional properties of the food material) or the rate thereof determined. One may then terminate the generation of the functional ingredient, when a suitable amount of functional ingredient has been generated, by heating the food material. Thus the amount of the functional ingredient and the
15 properties of the food material/foodstuff may easily be controlled.

Preferably, the enzyme is selected from lipases (EC 3.1.1.3), esterases, amylases, xylanases, proteases, lyases, including glucan lyases and α -1,4-glucan lyase, derivatives and mixtures thereof. More preferably, the enzyme is selected from lipases, esterases,
20 derivatives and mixtures thereof.

Preferably the enzyme is an enzyme as described in and/or as claimed in Danish Patent Application No. 0400/97. In other words preferably the enzyme is a polypeptide in glycosylated or non-glycosylated form capable of exhibiting lipase activity wherein the
25 polypeptide comprises at least one amino acid sequence selected from the group consisting of

(I) Ser-Val-Ser-Thr-Ser-Thr-Leu-Asp-Glu-Leu-Gln-Leu-Phe-Ala-Gln-Trp-Ser-Ala-Ala-Ala-Tyr-Xaa-Ser-Asn-Asn

30

(II) Val-His-Thr-Gly-Phe-Trp-Lys

(III) Ala-Trp-Glu-Ser-Ala-Ala-Asp-Glu-Leu-Thr-Ser-Lys-Ile-Lys

where Xaa represents an amino acid selected from the group consisting of Ala, Arg, Asn, Asp, Cys, Gln, Glu, Gly, His, Ile, Leu, Lys, Met, Phe, Pro, Ser, Thr, Trp, Tyr and
5 Val.

In a further aspect the enzyme may be an enzyme as described in and/or as claimed in International Patent Application No. PCT/IB98/00708, filed 6 May 1998.

10 Preferably, the enzyme is isolated from a plant (preferably soy bean, rice bran, corn, rapeseed, peanut, pineapple, potato, oat, wheat and/or sunflower seed), an animal (preferably an animal pancreas) or a microorganism. Preferably, the microorganism selected from *Aspergillus niger*, *Rhizopus delemar*, *Rhizopus arrhizus*, *Mucor miehei*, *Pseudomonas sp.*, *Candida rugosa*, *Pencilium roqueforti*, *Pencilium cyclopium*,
15 *Aspergillus tubingensis*, *Candida cylindracea*, *Thermomyces lanuginosus*, *Mucor javanicus*, *Candida antarctica*, *Chromobacterium viscosum*, *Pseudomanas fluorescens*, *Pseudomonas nitroreducans*, *Chromobacterium viscosum*, *Bacillus subtilis*, mutants and combinations thereof.

20 Preferably, the conversion agent is present in the foodstuff. More preferably, the conversion agent is present in an inactive form or in a denatured form in the foodstuff.

In one aspect of the present invention the at least one functional ingredient may be generated from the at least one constituent of the food material by two or more
25 conversion agents. The at least one constituent may be contacted with the two or more conversion agents at the same time or in series or a combination thereof.

Preferably, the at least one constituent of the food material is selected from esters, monoglycerides, diglycerides, triglycerides, fats, including lard, tallow and butter fat;
30 fatty acids, fatty acid esters, waxes, wax esters, oils including oils extracted from or derived from palm oil, sunflower oil, soya bean oil, safflower oil, cotton seed oil, ground nut oil, corn oil, olive oil, peanut oil, coconut oil and rape seed oil, proteins,

amino acids, protein hydrolysates, peptides (partly hydrolysed protein), a constituent comprising a hydroxy group (-OH), polyvalent alcohols, including glycerol; water, ethanol, sugars including sucrose, fructose, glucose (dextrose), lactose, and galactose; dextrin, sorbitol, mannitol, fruit acids and hydroxy acids including citric acid, tartaric acid, lactic acid and ascorbic acid; mixtures and derivatives thereof.

Preferably, the at least one constituent of the food material is in liquid form.

The term "triglyceride" preferably means a triester of an alcohol, preferably glycerol, and a fatty acid. More preferably the triglyceride fatty acid is a triester of an alcohol, preferably glycerol, and a C₄ to C₂₄ fatty acid. Preferably the triglyceride fatty acid has an iodine value of from 0 to 125, preferably from 0 to 60.

Preferably, the triglyceride is selected from triglycerides having a fatty acid chain length of no greater than 14 carbons, triglycerides having a fatty acid chain length of from 4 to 14 carbons, triglycerides having a fatty acid chain length of from 6 to 14 carbons, triglycerides having a fatty acid chain length of from 8 to 14 carbons, triglycerides having a fatty acid chain length of from 10 to 14 carbons, triglycerides having a fatty acid chain length of 12 carbons, triglycerides having a fatty acid chain length of from 16 to 24 carbons, triglycerides having a fatty acid chain length of from 16 to 22 carbons, triglycerides having a fatty acid chain length of from 18 to 22 carbons, triglycerides having a fatty acid chain length of from 18 to 20 carbons, mixtures and derivatives thereof.

Preferably, the functional ingredient is generated from at least two constituents of the food material. In this aspect at least two constituents of the foodstuff may interact and/or react and/or combine together to generate at least one functional ingredient. Preferably, the functional ingredient is generated from a first constituent and a second constituent of the food material.

Preferably, the first constituent and the second constituent are constituents of the foodstuff. In this aspect, the functional ingredient is generated from a first constituent and a second constituent of the food material and the first constituent and second

constituent are also present in the foodstuff. Thus the functional ingredient may be generated from constituents/ingredients of the food material which are only partially used to generate the functional ingredient. The remainder of the constituents/ingredients may be present in the foodstuff.

5

In a preferred aspect of the present invention the first constituent of the food material/foodstuff is hydrophobic and/or lipophilic.

Preferably, the first constituent of the food material/foodstuff is selected from esters, monoglycerides, diglycerides, triglycerides, fats, including lard, tallow and butter fat; 10 fatty acids, fatty acid esters, waxes, wax esters, oils including oils extracted from or derived from palm oil, sunflower oil, soya bean oil, safflower oil, cotton seed oil, ground nut oil, corn oil, olive oil, peanut oil, coconut oil and rape seed oil; derivatives and mixtures thereof. More preferably, the first constituent of the food 15 material/foodstuff comprises or is an ester or a triglyceride.

The term "triglyceride" preferably has the meaning defined above.

Preferably, the triglyceride of the first constituent is selected from triglycerides having a 20 fatty acid chain length of no greater than 14 carbons, triglycerides having a fatty acid chain length of from 4 to 14 carbons, triglycerides having a fatty acid chain length of from 6 to 14 carbons, triglycerides having a fatty acid chain length of from 8 to 14 carbons, triglycerides having a fatty acid chain length of from 10 to 14 carbons, triglycerides having a fatty acid chain length of 12 carbons, triglycerides having a fatty acid chain 25 length of from 16 to 24 carbons, triglycerides having a fatty acid chain length of from 16 to 22 carbons, triglycerides having a fatty acid chain length of from 18 to 22 carbons, triglycerides having a fatty acid chain length of from 18 to 20 carbons, mixtures and derivatives thereof.

30 Preferably, the first constituent of the food material/foodstuff is in liquid form.

In a preferred aspect of the present invention the second constituent of the food

material/foodstuff is hydrophilic.

In a preferred embodiment, the second constituent of the food material/foodstuff may be selected from proteins, amino acids, protein hydrolysates, peptides (partly hydrolysed
5 protein), mixtures and derivatives thereof.

In this aspect, wherein the first constituent of the food material/foodstuff is preferably a fatty acid, it is possible to esterify the free amino groups in the proteinaceous second constituent with fatty acid from the first constituent. In this manner, it is possible to
10 produce protein fatty acid condensate. Alternatively, the present invention provides a process; in which the first constituent of the food material/foodstuff is selected from esters, monoglycerides, diglycerides, triglycerides, fats (including tallow and lard), fatty acid esters, and oils (including palm oil, and soya oil rape seed oil), and in which the second constituent is proteinaceous; wherein the first constituent interesterifies with the
15 proteinaceous second constituent. In these manners, it is possible to produce protein fatty acid condensate.

Protein fatty acid condensate has very good surface active properties. Protein fatty acid condensate is known within the cosmetic and textile industry (see Herstellung und
20 Anwendungsmöglichkeiten von Eiweiss-Fettsäurekondensaten. Andreas Sander, Eberhard Eilers, Andrea Heilmann, Edith von Kreis. Fett/lipid 99 (1997) Nr. 4, 115-120). This condensate is normally produced by a reaction between protein and fatty acid chloride as disclosed in Sander et al. However, enzymatic processes for the production of protein fatty acid condensate from protein and fatty acid is known (WO
25 97/14713). The present applicants have identified that by utilising the commonly occurring constituents of food material, an emulsifier in the form of protein fatty acid condensate may be provided.

This is particularly advantageous because protein forms part of many types of food and
30 is the basic material in many products, for example meat products. In the food industry protein is also often used as a purified protein isolated from milk and plants, such as soya, wheat, rice. Protein is also prepared and is available in hydrolysed form, i.e.

protein hydrolysate, peptides or amino acids.

In the above aspect of the present invention, wherein a protein fatty acid condensate is formed, it is important to contact the first constituent and the second constituent with the conversion agent under conditions of agitation. Moreover, it is important to contact these constituents under conditions of controlled water activity. Both of these preferred features will assist in obtaining a maximum conversion rate of first constituents/second constituent to functional ingredient.

10 Preferably, the second constituent of the food material/foodstuff is selected from a constituent comprising a hydroxy group (-OH), polyvalent alcohols, including glycerol; water, ethanol, sugars including sucrose, fructose, glucose (dextrose), lactose, and galactose; dextrin, sorbitol, mannitol, fruit acids and hydroxy acids including citric acid, tartaric acid, lactic acid and ascorbic acid; mixtures and derivatives thereof. More preferably, the second constituent of the food material/foodstuff is glycerol.

In a further preferred embodiment, the first constituent of the food material/foodstuff is an ester, preferably a triglyceride and the second constituent of the food material/foodstuff is a constituent comprising a hydroxy group (-OH). Preferably, the first constituent of the food material/foodstuff is a triglyceride. Preferably, the second constituent of the food material/foodstuff is an alcohol, more preferably a polyvalent alcohol, yet more preferably glycerol.

25 Preferably, the second constituent of the food material/foodstuff is in liquid form.

In a highly preferred embodiment, the first constituent of the food material/foodstuff is a constituent comprising at least two ester groups, preferably a triester, more preferably a triglyceride and the second constituent of the food material/foodstuff is a sugar or a sugar alcohol. In this highly preferred aspect the first constituent and the second constituent may interact on contact with the a conversion agent to generate an ester derived from the first constituent wherein the ester has a lower degree of esterification than the first constituent, and a sugar ester. This is extremely advantageous because the

ester may act as a functional ingredient, such as an emulsifier, and the sugar ester may also act as a functional ingredient, such as an emulsifier or an anti-oxidant. Thus, two functional ingredients may be generated from two constituents of the food material/foodstuff by a conversion agent.

5

In the above highly preferred aspect the second constituent is preferably ascorbic acid. Ascorbic acid ester is an antioxidant.

Thus, in a further broad aspect of the present invention there is provided a foodstuff
10 prepared from a food material, wherein the foodstuff comprises at least two functional ingredients, and wherein the at least two functional ingredients have been generated from a first constituent of the food material and a second constituent of the food material by a conversion agent. Preferably, the first constituent is a constituent comprising at least two ester groups, preferably a triester, more preferably a triglyceride.
15 Preferably, the second constituent is a sugar or a sugar alcohol, more preferably ascorbic acid.

In a preferred aspect, the first constituent of the food material/foodstuff and the first constituent of the food material/foodstuff are in liquid form.

20

In a further preferred aspect, the food material/foodstuff further comprises greater than two constituents. Preferably, the food material/foodstuff further comprises a third constituent. The third constituent may be selected from the constituents listed above in respect of the first and second constituents. Preferably, the third constituent is selected
25 from a constituent comprising a hydroxy group (-OH), polyvalent alcohols, including glycerol; water, ethanol, sugars including sucrose, fructose, glucose (dextrose), lactose, and galactose; dextrin, sorbitol, mannitol, fruit acids and hydroxy acids including citric acid, tartaric acid, lactic acid and ascorbic acid; mixtures and derivatives thereof.

30 Preferably, the third constituent of the food material/foodstuff is selected from sugars including sucrose, fructose, glucose (dextrose), lactose, and galactose; dextrin, sorbitol, mannitol, fruit acids and hydroxy acids including citric acid, tartaric acid, lactic acid and

ascorbic acid; mixtures and derivatives thereof.

In a highly preferred aspect of the present invention the second constituent of the food material/foodstuff is selected from polyvalent alcohols, preferably glycerol, and the
5 third constituent of the food material/foodstuff is selected from sugars. In an alternative highly preferred aspect of the present invention the second constituent of the food material/foodstuff is selected from polyvalent alcohols, preferably glycerol, and the third constituent of the food material/foodstuff is selected from proteins, peptides and amino acids. These preferred aspects are advantageous because the third constituent
10 may be soluble in the second constituent. Thus, the second constituent can readily react with the third constituent. Moreover, when the first constituent of the food material/foodstuff is in liquid form, the second constituent and/or the third constituent can readily react with the first constituent.

15 The provision of one or more constituents in liquid form as described above may significantly increase the reaction velocity of the generation of the least one functional ingredient.

The conversion agent may be contacted with the all of the food material or a portion
20 thereof. In the latter case, a portion of the food material may be removed from the total amount of food material. After contacting the conversion agent with the portion of food material, the portion may be returned to the remainder of food material. The portion of the food material may comprises from 0.1 to 10 wt % of the total food material, preferably from 0.1 to 5 wt % of the total food material, preferably from 0.1 to 2 wt %
25 of the total food material, more preferably from 0.5 to 1 wt % of the total food material.

The conversion agent may be contacted with a carrier prior to contact with the food material. Preferably, the carrier is a constituent of the food material. Preferably, the carrier is a first constituent or a second constituent of the food material as defined
30 above. More preferably, the carrier is glycerol.

The conversion agent may be contacted with the food material under supercritical

conditions. In this aspect the conversion agent may be contacted with the food material in a carbon dioxide solvent. Preferably, the carbon dioxide solvent comprises a mixture of carbon dioxide and an alcohol.

- 5 Preferably, the functional ingredient of the present invention is generated by a reaction selected from alcoholysis, preferably glycerolysis, hydrolysis, interesterification, and combinations thereof. More preferably the functional ingredient is generated by a alcoholysis reaction, preferably a glycerolysis reaction.
- 10 Preferably, the functional ingredient comprises less than 5 wt % of the foodstuff. Preferably, the functional ingredient comprises from 0.01 to 4 wt % of the foodstuff. Preferably, the functional ingredient comprises from 0.01 to 2 wt % of the foodstuff. Preferably, the functional ingredient comprises from 0.01 to 1 wt % of the foodstuff. Preferably, the functional ingredient comprises from 0.01 to 0.5 wt % of the foodstuff.
- 15 Preferably, the functional ingredient comprises from 0.01 to 0.3 wt % of the foodstuff.

Preferably, the at least one functional ingredient comprises or is a functional ingredient selected from emulsifiers, hydrocolloids, preservatives, antioxidants, colourings and flavourings. More preferably, the at least one functional ingredient comprises or is an emulsifier. In this aspect, preferably the emulsifier comprises from 0.1 to 0.3 wt % of the foodstuff.

20

The emulsifier may comprises or may be selected from monoglycerides, diglycerides, derivatives and mixtures thereof.

25

The antioxidant may be anhydrofructose. In this aspect, the at least one constituent is preferably a glucan, more preferably a starch. In this aspect, the conversion agent is preferably a lyase enzyme, yet more preferably an enzyme as described in and/or as claimed in International Patent Application No. PCT/IB98/00708, filed 6 May 1998.

30

In one aspect of the present invention the at least one functional ingredient is other than an antioxidant. In a further aspect of the present invention the foodstuff does not

contain an antioxidant generated in accordance with the present invention. In a further aspect of the present invention the foodstuff does not contain an antioxidant.

5 A person skilled in the art will appreciate that the at least one constituent of the food material from which the functional ingredient is generated may be selected to provide a required functional ingredient. Thus in the above aspect wherein the functional ingredient is an emulsifier, preferably an emulsifier selected from monoglycerides, diglycerides, derivatives and mixtures thereof, the at least one constituent may be, for example, a triglyceride and a polyvalent alcohol.

10

In a preferred aspect the present invention provides foodstuff as defined above wherein the foodstuff is selected from baked goods, including breads, cakes, sweet dough products, laminated doughs, liquid batters, muffins, doughnuts, biscuits, crackers and cookies; confectionery, including chocolate, candies, caramels, halawa, gums, including 15 sugar free and sugar sweetened gums, bubble gum, soft bubble gum, chewing gum and puddings; frozen products including sorbets, preferably frozen dairy products, including ice cream and ice milk; dairy products, including coffee cream, whipped cream, custard cream, milk drinks; mousses, whipped vegetable creams, meat products, including processed meat products; edible oils and fats, aerated and non-aerated whipped 20 products, oil-in-water emulsions, water-in-oil emulsions, margarine, shortening and spreads including low fat and very low fat spreads; dressings, mayonnaise, dips, cream based sauces, cream based soups, beverages, spice emulsions, sauces and mayonnaise.

25

In one aspect of the present invention the foodstuff is a foodstuff other than mayonnaise. The claims of the present application are to be construed to include each of the foodstuffs listed above.

30

In a preferred embodiment the foodstuff of the present invention is a spread, preferably a margarine.

Thus in a preferred aspect the present invention provides a margarine prepared from a

food material, wherein the foodstuff comprises at least one functional ingredient, and wherein the at least one functional ingredient has been generated from at least one constituent of the food material by a conversion agent.

- 5 In a further preferred embodiment the foodstuff comprises greater than 30 wt % fat (i.e. triglycerides), more preferably greater than 40 wt % fat, yet more preferably greater than 50 wt % fat.

The foodstuff may comprise an emulsion of oil and water. The emulsion may be an oil-
10 in-water emulsion. The emulsion may be an water-in-oil emulsion.

The invention will now be described, by way of example only, with reference to the following examples

15 **EXAMPLES**

Example 1 - Full-fat Table Margarine

Full-fat table margarine is used for spreading on bread and household baking.

20

Each of fat blends A, B and C listed in Table 1 were treated with lipase as follows. 1 part of the fat blend is heated to 50°C during stirring 0.2 part of lipase (obtained from *Aspergillus tubingensis*) dispersed in glycerol is added. The fat blend is reacted for 12 hours at 50 °C and then shortly heated to 100 °C to denature the enzyme.

25

Table 1

| Fat blends | A | B | C |
|---------------------------|--------|---------|---------|
| Margarine used at approx. | 5-10°C | 20-25°C | 25-30°C |
| Soya 41°C | 20 | - | - |

| | | | |
|--|------|------|------|
| Soya 35°C | 20 | - | - |
| Soya oil | 60 | 25 | 20 |
| Palm 43°C | - | 25 | 30 |
| Palm oil | - | 50 | 50 |
| SFC* values of fat blends (IUPAC method) | A | B | C |
| 5°C | 34 | 47 | 54 |
| 10°C | 28 | 45 | 50 |
| 20°C | 14 | 26 | 30 |
| 30°C | 3 | 10 | 12 |
| 35°C | 0 | 5 | 7 |
| 40°C | 0 | 1 | 2 |
| Slip melting point °C (AOCS 3-25 method) | 26.3 | 36.9 | 36.8 |

* Solid fat content

The treated fat blends were then processed in accordance with the following steps to
5 prepare a recipe shown in Table 2

1. Blend the water phase ingredients. (If required, pasteurise the water phase by heating to approx. 80°C). Adjust pH with Ferment Flavouring 4646.
2. Melt the fat phase, and temper to approx. 40-45°C. Add the β -carotene.
- 10 3. Add the flavouring.
4. Add the water phase to the fat phase, stirring continuously.
5. Cool in a tube chiller (normal capacity, normal cooling) to an outlet temp of 8-10°C.

Table 2

| | | |
|--------------|--|-------|
| Water phase: | Water | 16.0% |
| | Skimmed milk powder or whey powder | 1.0% |
| | Salt | 1.0% |
| | pH 5.0-5.5 with Ferment Flavouring 4646* | |
| Fat phase: | Lipase treated fat | 1.2% |
| | Soya lecithin | 0.2% |
| | β -carotene | 4 ppm |
| | Fat blend | 80.6% |
| | Butter Flavouring 3559** | 0.01% |

* Ferment Flavouring 4646 - a nature-identical, water-soluble flavouring which ensures a good, lactic and fermented taste. Used for direct acidification of the water phase to ensure the taste similar to that obtained by microbial fermentation of the milk

** Butter Flavouring 3559 - a nature-identical, fat-soluble flavouring which provides a rich, fermented butter taste.

The fat contacted with lipase generated an emulsifier, a functional ingredient which is important in the preparation of margarine. Each of the margarines prepared from fat blends A, B and C was visually inspected and found to be substantially identical in appearance to conventionally prepared margarine. No separation of the oil and water phases was observed. Each of the margarines prepared from fat blends A, B and C was also spread on bread and tasted. The organoleptic properties of each margarine were pleasant and were felt by the taster to be substantially identical to those of conventionally prepared margarine.

Example 2 - 60% Fat Spread with Protein

20

60% fat spread with protein is used for spreading on bread and open pan frying instead of full-fat products.

Each of fat blends A and B listed in Table 3 were treated with lipase as follows. 1 part of the fat blend is heated to 50°C during stirring 0.2 part of lipase (obtained from *Rhizopus arrhizus*) dispersed in glycerol is added. The fat blend is reacted for 12 hours at 50 °C and then shortly heated to 100 °C to denature the enzyme.

Table 3

| Fat blends | A | B |
|--|--------|---------|
| Spread used at approx. | 5-10°C | 20-25°C |
| Soya 41°C | 25 | 20 |
| Soya 35°C | - | 45 |
| Soya oil | 75 | 35 |
| SFC values of fat blends (IUPAC method) | A | B |
| 5°C | 23 | 48 |
| 10°C | 19 | 46 |
| 20°C | 9 | 28 |
| 30°C | 2 | 8 |
| 35°C | 0 | 2 |
| 40°C | 0 | 0 |
| Slip melting point °C (AOCS 3-25 method) | 26.6 | 31.7 |

The treated fat blends were then processed in accordance with the following steps to prepare a recipe shown in Table 4

1. Blend the water phase ingredients. (If required, pasteurise the water phase by heating to approx. 80°C). Adjust pH.
2. Melt the fat phase, and temper to approx. 40-45°C. Add the β -carotene.
3. Add the flavouring.

4. Add the water phase to the fat phase, stirring vigorously.
5. Crystallise and knead vigorously in a tube chiller (80% of normal capacity, NH₃ - 15°C, 2 tubes) to an outlet temperature of 8-10°C

5

Table 4

| | | |
|------------------------|------------------------|-------|
| Water phase at pH 5.5: | Water | 37.9% |
| | Whey powder | 1.0% |
| | Salt | 1.0% |
| | K-sorbate | 0.1% |
| Fat phase: | Lipase treated fat | 1.4% |
| | β-carotene | 4 ppm |
| | Fat blend | 58.6% |
| | Butter Flavouring 3559 | 0.01% |

The fat contacted with lipase generated an emulsifier. Both of the margarines prepared from fat blends A and B was visually inspected and found to substantially identical in appearance to conventionally prepared margarine. No separation of the oil and water phases was observed. Both of the margarines prepared from fat blends A and B was also spread on bread and tasted. The organoleptic properties of each margarine was pleasant and were felt by the taster to be substantially identical to those of conventionally prepared margarine.

15

Example 3 - 40% Fat Spread with Whey Powder

Fat blend A listed in Table 3 above was treated with lipase as follows. 1 part of the fat blend is heated to 50°C during stirring 0.2 part of lipase (obtained from *Candida rugosa*) dispersed in glycerol is added. The fat blend is reacted for 12 hours at 50 °C and then shortly heated to 100 °C to denature the enzyme and used for 40% fat spread production. The spread had a composition shown in Table 5 below.

20

Table 5

| | | |
|-----------------------|---|--------|
| Water phase at pH 5.5 | Water | 55.16% |
| | Salt | 1.2% |
| | K-sorbate | 0.1% |
| | Whey powder | 1.0% |
| | GRINDSTED™ Pectin LFS 100 | 1.0% |
| Fat phase | Fat blend - 25 parts soya 41° - 75 parts liquid oil | 39.5% |
| | β-carotene | 4ppm |
| | Butter Flavouring 2873 | 0.01% |
| | Butter Flavouring 3507 | 0.01% |
| | Lipase treated fat | 2.0% |

The fat contacted with lipase generated an emulsifier. The low-fat spread was stable and had good water dispersion. Sensory evaluation of the sample showed that they had a very good flavour release and colour.

Example 4 - Filling Cream.

Each of fat blends A and B listed in Table 3 above were treated with lipase as follows. 1 part of the fat blend is heated to 45°C during stirring 0.2 part of lipase (obtained from *Rhizopus delemar*) dispersed in glycerol is added. The fat blend is reacted for 12 hours at 45 °C and then shortly heated to 100 °C to denature the enzyme and used for filling cream production..

15

Filling cream was made in a ice cream freezer with mono-pump (capacity 27 kg/hr). Nitrogen blown in after the pump and before the cooling cylinder. Outlet temperature: 15-17 °C.

The filling cream spread had a composition shown in Table 6 below.

Table 6

| | | |
|-------------|--------------------------------|-------|
| Water phase | Water | 12.5% |
| | GRINDSTED™ Pectin LFS 100 | 0.5% |
| | SMP | 8.0% |
| | Sucrose | 9.9% |
| | Invert sugar | 9.0% |
| | Sorbitol 70% | 8.0% |
| | Glucose syrup | 14.0% |
| | Glycerol | 7.0% |
| | K-sorbate | 0.1% |
| Fat phase | Lipase treated fat | 3,0% |
| | Lecithin | 0,4% |
| | Fat blend (100% coconut 31 °C) | 27.6% |
| | Butter flavouring 2598 | 0.03% |

5

The fat contacted with lipase generated an emulsifier. The filling cream was smooth with good flavour release. Specific gravity of the cream: 0.8 g/ml.

Example 5 - Ice cream

10

1 part of soya fat 41 ° is heated to 45 °C during stirring 0.2 part of lipase (obtained from *Aspergillus niger*) dispersed in glycerol is added. The fat blend is reacted for 12 hours at 45 °C and then shortly heated to 100 °C to denature the enzyme and used for ice cream production.

15

The treated fat was then processed in accordance with the following steps to prepare a recipes shown in Table 7

1. Heat all liquid ingredients to approx. 40 °C

2. Add dry ingredients. (stabiliser blend is mixed with sugar before addition)
3. If butter/butter oil or veg. fat is used it must be melted separately and added to the mix at 40 °C, or via a static mixer at the entrance to the homogeniser by means of a dosing pump.
- 5 4. Pasteurise at 80 -85 °C/20-40 seconds
5. Homogenise at 80 °C (190 bar for recipe 1 and 175 bar for recipe 2)
6. Cool to ageing temperature , 4 °C
7. Freeze in continuous freezer to desired overrun (100% recommended)
8. Harden in tunnel at -40 °C
- 10 9. Store below -25 °C

Table 7

| Recipe | 1 | 2 |
|------------------------------|----------|----------|
| | Milk fat | Veg. fat |
| Dairy cream, 38% | 23.65 | |
| Skimmed milk | 53.30 | |
| Skimmed milk powder | 4.90 | 11.30 |
| Vegetable fat (HCO) | | 8.00 |
| Sugar | 12.00 | 12.00 |
| Glucose syrup, DE 42, 75% TS | 5.25 | 5.25 |
| Stabiliser blend | 0.2 | 0.2 |
| Lipase treated fat | 0.6 | 0.6 |
| Grindsted Flavouring 2976 | 0.1 | 0.1 |
| Colour | + | + |
| Water | | 62.55 |

The fat contacted with lipase generated an emulsifier. Ice cream of both recipes had a good taste and excellent creamy mouthfeel.

5 Example 6 -Margarine

In a vessel 0.6 part of sun flower oil and 0.4 part of palm oil and 0.15 part of lipase from *Rhizopus arrhizus* dissolved glycerol/water is added. The reaction is continued for 20 hours at 45°C and then shortly treated by 100°C in order to inactivate the enzyme.

10

Two recipes were prepared. These recipes are shown in Table 8 below. Recipe 1 was in accordance with a prior art method - a previously prepared mono/di glyceride emulsifier (DIMODAN[®] CP available from Danisco Ingredients, Denmark) was added. Recipe 2 was in accordance with the present invention. In recipe 2, 1.7% of the fat phase was provided by the above lipase treated fat. The lipase treated fat was added to the fat blend for margarine production and the margarine is produced by standard procedures for margarine production.

20

Table 8

| Recipe | 1 | 2 |
|----------------------|------|------|
| WATER PHASE | | |
| Water | 480 | 480 |
| Salt | 30 | 30 |
| Skim Milk Powder | 30 | 30 |
| Potassium Sorbate | 3 | 3 |
| EDTA | 0.45 | 0.45 |
| pH | 5.5 | 5.5 |
| FAT PHASE | | |
| Soya 41 ^o | 490 | 481 |
| Soya 35 ^o | 490 | 481 |

| | | |
|-------------------------|------|------|
| Soya oil | 1471 | 1444 |
| DIMODAN [®] CP | 6.0 | - |
| Lipase | - | 51.0 |
| PPM β -carotene | 0.5 | 0.5 |
| Flavourings | 0.6 | 0.6 |

The fat contacted with lipase generated an emulsifier. The margarine in accordance with the present invention was visually inspected and found to substantially identical in appearance to the conventionally prepared margarine. No separation of the oil and water phases was observed. The margarine in accordance with the present invention was also spread on bread and tasted. The organoleptic properties of the margarine was pleasant and were felt by the taster to be substantially identical to those of the conventionally prepared margarine.

10 Example 7 -Margarine

In a vessel 1 part of palm oil and 0.15 part of esterase from *Candida* dissolved in sugar (sucrose)/water is added. The reaction is continued for 20 hours at 55°C and then shortly treated by 100°C in order to inactivate the enzyme.

15

1% of this reaction mixture is added to a fat blend for margarine production and the margarine is produced by standard procedures for margarine production.

The reaction mixture gives good water in oil emulsification properties.

20

Example 8 -Margarine

In a vessel 1 part of palm oil and 0.15 part of lipase from *Candida* dissolved citric acid/glycerol/water is added. The reaction is continued for 20 hours at 55°C and then shortly treated by 100°C in order to inactivate the enzyme.

25

1% of this reaction mixture is added to a fat blend for margarine production and the margarine is produced by standard procedures for margarine production.

The reaction mixture gives good water in oil emulsification and also contributes to
5 reduce spattering when the margarine is used for frying.

Example 9 -Margarine

In a vessel 1 part of palm oil and 0.05 part of lipase from *Aspergillus niger* dissolved
10 water is added. The reaction is continued for 20 hours at 40°C and then shortly treated
by 100°C in order to inactivate the enzyme.

1% of this reaction mixture is added to a fat blend for margarine production and the
margarine is produced by standard procedures for margarine production.

15

The reaction mixture gives good water in oil emulsification.

Example 10 -Margarine

20 In a vessel 0.8 part of sun flower oil and 0.2 part of soya protein hydrolysate and 0.05
part of lipase from *Rhizopus arrhizus* is added. The reaction is continued for 2 days at
55°C during vigorous agitation, and then shortly treated by 100°C in order to inactivate
the enzyme.

25 2% of this reaction mixture is added to a fat blend for margarine production and the
margarine is produced by standard procedures for margarine production.

The reaction mixture gives good water in oil emulsification.

30 Example 11 -Ice Cream

In a vessel 0.6 part of palm oil and 0.4 part of milk protein and 0.05 parts of lipase from

Candida is added. The reaction is continued for 2 days at 55°C and then shortly treated by 100°C in order to inactivate the enzyme.

1% of this reaction mixture is used for ice cream production.

5

The reaction mixture gives good water in oil emulsification properties and stabilise lipid protein boundaries.

Example 12 - Custard Cream

10

In a vessel 1 part of palm oil and 0.3 part peptides from soya bean protein and 0.05 parts of lipase from *Candida* is added. The reaction is continued for 3 days at 55°C and then shortly treated by 100°C in order to inactivate the enzyme.

15 2% of this reaction mixture is used for the production of custard cream.

The reaction mixture gives good water in oil emulsification and contributes to improved stability and mouth feel.

20 Example 13 - Margarine

In a vessel 0.75 part of soya bean oil, 0.25 part milk protein and 0.05 part of lipase from *Aspergillus niger* is added. The reaction is continued for 3 days at 40°C and then shortly treated by 100°C in order to inactivate the enzyme.

25

2% of this reaction mixture is added to a fat blend for margarine production and the margarine is produced by standard procedures for margarine production.

The reaction mixture gives good water in oil emulsification.

30

Example 14 - Sponge Cake

0.05 parts of sugar is dissolved in 0.15 part of glycerol. To this solution 0.75 part of soya bean oil, and 0.05 part of lipase from *Rhizopus arrhizus* is added. The reaction is continued during stirring for 1 day at 45°C and then the reaction mixture, comprising a functional ingredient, is shortly treated at 100°C in order to inactivate the enzyme.

5

This reaction mixture is used for sponge cake production. The reaction mixture gave good emulsification properties and produced a cake with a stable crumb structure and a good volume.

10 Sponge Cake Recipe

| Ingredients | Gram |
|-----------------------|------|
| Sugar | 208 |
| Wheat Flour | 188 |
| Corn starch | 60 |
| Baking Powder | 14 |
| Egg | 200 |
| Soya oil | 40 |
| Water | 110 |
| Functional ingredient | 30 |

Procedure

Mix all ingredients for 6 min. on a Hobart N50 mixer.

15 Scale 2 x 350 g into round sponge cake tins.

Bake 35 min at 180°C

20 All publications mentioned in the above specification are herein incorporated by reference. Various modifications and variations of the described methods and system of the invention will be apparent to those skilled in the art without departing from the scope and spirit of the invention. Although the invention has been described in connection with specific preferred embodiments, it should be understood that the

invention as claimed should not be unduly limited to such specific embodiments. Indeed, various modifications of the described modes for carrying out the invention which are obvious to those skilled in chemistry or related fields are intended to be within the scope of the following claims.

CLAIMS

1. Use of a conversion agent to prepare from a food material a foodstuff comprising at least one functional ingredient, wherein the at least one functional ingredient has been generated from at least one constituent of the food material by the conversion agent.
5
2. A process for preparing a foodstuff comprising the steps of
 - (i) providing a food material;
 - 10 (ii) contacting the food material with a conversion agent such that a functional ingredient is generated by the conversion agent from at least one constituent of the food material.
3. A foodstuff prepared from a food material, wherein the foodstuff comprises at least one functional ingredient, and wherein the at least one functional ingredient has been generated from at least one constituent of the food material by a conversion agent.
15
4. Invention according to claim 1, 2 or 3 wherein the conversion agent is present in the foodstuff .
20
5. Invention according to any one of the preceding claims wherein the conversion agent is a catalyst.
6. Invention according to claim 5 wherein the conversion agent is an enzyme.
25
7. Invention according to claim 6 wherein the enzyme is selected from lipase, esterase, derivatives and mixtures thereof.
8. Invention according to claim 6 or 7 wherein the enzyme is isolated from a plant, an animal or a microorganism.
30
9. Invention according to claim 8 wherein the microorganism is selected from

Aspergillus niger, *Rhizopus delemar*, *Rhizopus arrhizus*, *Mucor miehei*, *Pseudomonas* sp., *Candida rugosa*, *Pencilium roqueforti*, *Pencilium cyclopium*, *Aspergillus tubingensis*, *Candida cylindracea*, *Thermomyces lanuginosus*, *Mucor javanicus*, *Candida antarctica*, *Chromobacterium viscosum*, *Pseudomanas fluorescens*,
5 *Pseudomonas nitroreducans*, *Chromobacterium viscosum*, *Bacillus subtilis* mutants and combinations thereof.

10 10. Invention according to any one of the preceding claims wherein the conversion agent is present in an inactive form or a denatured form in the foodstuff.

11. Invention according to any one of the preceding claims wherein the functional ingredient is generated from at least two constituents of the food material.

12. Invention according to any one of the preceding claims wherein the functional
15 ingredient is generated from a first constituent and a second constituent of the food material.

13. Invention according to claim 12 wherein the first constituent and the second constituent are constituents of the foodstuff.

20 14. Invention according to claim 12 or 13 wherein the first constituent is hydrophobic and/or lipophilic.

15 15. Invention according to any one of claims 12 to 14 wherein the first constituent is selected from fats, oils, fatty acids, derivatives and mixtures thereof.

16. Invention according to any one of claims 12 to 15 wherein the second constituent is hydrophilic.

30 17. Invention according to any one of claims 12 to 16 wherein the second constituent is selected from a constituent comprising a hydroxy group (-OH), polyvalent alcohols, including glycerol; water, ethanol, sugars including sucrose, fructose, glucose

(dextrose), lactose, and galactose; dextrin, sorbitol, mannitol, fruit acids and hydroxy acids including citric acid, tartaric acid, lactic acid and ascorbic acid; mixtures and derivatives thereof.

5 18. Invention according to claims 12 to 16 wherein the second constituent is selected from proteins, amino acids, protein hydrolysates, peptides (partly hydrolysed protein), derivatives and mixtures thereof.

10 19. Invention according to any one of the preceding claims wherein the foodstuff is selected from baked goods, including breads, cakes, muffins, doughnuts, biscuits, crackers and cookies; confectionery, including candies, caramels, chocolate and puddings; frozen products, preferably frozen dairy products, including ice cream and ice milk; dairy products, including coffee cream, whipped cream, custard cream, milk drinks; meat products, including processed meat products; edible oils and fats, including
15 w/o emulsions, o/w emulsions, margarine shortening and spreads; fine foods, including sauces and mayonnaise.

20 20. Invention according to claim 1 wherein the foodstuff comprises at least two functional ingredients, and wherein the at least two functional ingredient have been generated from a first constituent of the food material and a second constituent of the food material by a conversion agent.

25 21. Invention according to claim 20 wherein the first constituent is a constituent comprising at least two ester groups, preferably a triester, more preferably a triglyceride.

22. Invention according to claim 20 or 21 wherein the second constituent is a sugar or a sugar alcohol, more preferably ascorbic acid.

30 23. Invention according to any one of the preceding claims wherein the at least one functional ingredient comprises or is an emulsifier.

24. Use according to claim 1 substantially as hereinbefore described.

25. Process according to claim 2 substantially as hereinbefore described.
26. Foodstuff according to claim 3 substantially as hereinbefore described.

ABSTRACT**Foodstuff**

- 5 There is provided use of a conversion agent to prepare from a food material a foodstuff comprising at least one functional ingredient, wherein the at least one functional ingredient has been generated from at least one constituent of the food material by the conversion agent.